December 1967 Brief 67-10553

NASA TECH BRIEF

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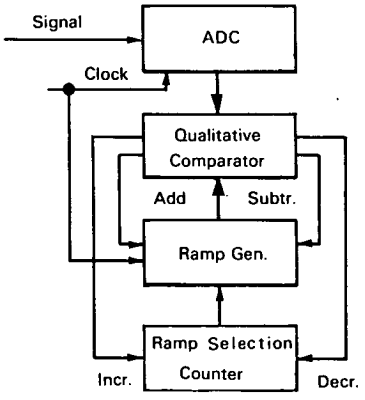
Simple First Order Data Compression Processor Concept



The problem:

Most prior art data-compression processing systems require the use of a computer. It is desirable to get away from such expensive and sophisticated systems and develop a system of simple counting and qualitative comparison functions requiring no computing functions or stored program operation.

The solution:

A system based on an analog-to-digital converter (ADC), includes a qualitative comparator for comparison of the ADC output with a ramp generator, which is connected as a bidirectional binary counter with selective inputs. A bidirectional "ramp" counter selects the proper ramp through a ramp generator selection network.

How it's done:

An analog signal is sampled at any arbitrary point in time by the ADC. For the next period of time, the signal is expected to follow one of a number of slopes. These slopes are generated by the digital ramp generator. This generator is simply a counter that is incremented or decremented in sync with the sampling of the signal by 1/4, 1/2, 1, 2, etc. units for each sample. The ramp generator is set to the value of the sample at the time the sample is accepted. The possible ramps form a fan with its vertex at the sample point. The ramps of the fan are numbered and a ramp is activated by the output of the ramp counter; that is, the signal will be compared only to that ramp or, more precisely, to two slopes that form the boundaries about the selected ramp. At the sample time the signal is at the center of this band. The positive and negative tolerance from the center ramp is named the aperture. The purpose of the comparison is to locate the first sample that lies outside the boundaries; this sample then will be accepted. The comparison is accomplished as follows: Each sample is compared to the reference signal, the selected ramp. Two outcomes are possible: either the signal is smaller or greater than the reference signal at the point of comparison. If the sample is greater, the aperture is added to the reference signal and a second comparison is made using the same comparator. Now the signal is compared to the reference signal plus the aperture.

(continued overleaf)

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There are two outcomes of this comparison: either the outcome is the same as the first, or it is not (i.e., it is the reverse). If it is the same, the sample is accepted; but if it is reversed, the signal is not accepted. If the outcome of the first comparison shows the signal to be smaller than the reference signal, the aperture is subtracted from the reference signal and a second comparison is made. If the outcome is the same (the signal smaller than the reference minus the aperture), the sample is accepted, otherwise not.

To simplify the addition or subtraction, the aperture is assumed to be one of the binary integers 1, 2, 4, 8 or 16, etc. The operation then becomes a simple count-up or count-down operation with the entry at the appropriate bit for the ramp generator and for the ramp selection counter, a simple up-down counter clocked at sample time if the last sample was accepted.

To select the most likely ramp, the ramp selection counter is decremented if the accepted sample is above the upper boundary of the tolerance band and incremented if the sample is below the lower boundary. The ramp generator is preset to the value of the sample. The more out of line the first arbitrary selection is, the more rapid the correction. When the correct ramp has been selected, fewer samples are accepted. The dynamic range of the ramp generator is assumed to be the same as for the ADC.

The qualitative comparator makes the decision as to whether the sample is accepted or rejected and the bidirectional ramp selection counter, operating through the ramp generator selection network, selects the proper ramp.

Note:

This development is in conceptual stage only and, as of date of publication of this Tech Brief, neither a model nor prototype has been constructed.

Patent status:

No patent action is contemplated by NASA.

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